Name: ________________________________ Date: ________________

Polynomial Operations SOLUTION (version 207)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -9x^5 + 4x^4 + 5x^3 - 10x^2 - 1$$

$$q(x) = 5x^5 + 3x^4 + 4x^3 + 8x - 2$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$p(x) = (-9)x^5 + (4)x^4 + (5)x^3 + (-10)x^2 + (0)x^1 + (-1)x^0$$
$$q(x) = (5)x^5 + (3)x^4 + (4)x^3 + (0)x^2 + (8)x^1 + (-2)x^0$$
$$p(x) - q(x) = (-14)x^5 + (1)x^4 + (1)x^3 + (-10)x^2 + (-8)x^1 + (1)x^0$$
$$p(x) - q(x) = -14x^5 + x^4 + x^3 - 10x^2 - 8x + 1$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 2x^2 - 8x - 5$$

$$b(x) = -4x + 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$2x^2$	$-8x$	-5
$-4x$	$-8x^3$	$32x^2$	$20x$
5	$10x^2$	$-40x$	-25

$$a(x) \cdot b(x) = -8x^3 + 32x^2 + 10x^2 + 20x - 40x - 25$$

Combine like terms.

$$a(x) \cdot b(x) = -8x^3 + 42x^2 - 20x - 25$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 7x - 2 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 7 & -2 \\ -8 & & -16 & -8 & 8 \\ \hline & 2 & 1 & -1 & 6 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x - 1 + \frac{6}{x+8}$$

In other words, $h(x) = 2x^2 + x - 1$ and the remainder is $R = 6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 7x - 2$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \ + \ (17)\cdot(-8)^2 \ + \ (7)\cdot(-8) \ + \ (-2) \\ &= (2)\cdot(-512) \ + \ (17)\cdot(64) \ + \ (7)\cdot(-8) \ + \ (-2) \\ &= (-1024) \ + \ (1088) \ + \ (-56) \ + \ (-2) \\ &= 6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = 6$.